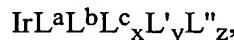


CLAIMS

What is claimed is:

1. An organic electronic device comprising an emitting layer wherein at least 20% by weight of the emitting layer comprises at least one compound having  
5 a formula below:



where:

x = 0 or 1, y = 0, 1 or 2, and z = 0 or 1, with the proviso that:

x = 0 or y + z = 0 and

10 when y = 2 then z = 0;

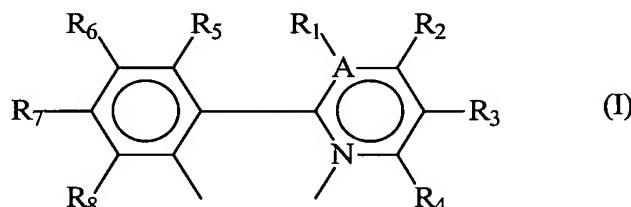
L' = a bidentate ligand or a monodentate ligand, and is not a phenylpyridine, phenylpyrimidine, or phenylquinoline; with the proviso that:

when L' is a monodentate ligand, y+z = 2, and

15 when L' is a bidentate ligand, z = 0;

L'' = a monodentate ligand, and is not a phenylpyridine, and phenylpyrimidine, or phenylquinoline; and

20 L<sup>a</sup>, L<sup>b</sup> and L<sup>c</sup> are alike or different from each other and each of L<sup>a</sup>, L<sup>b</sup> and L<sup>c</sup> has structure (I) below:

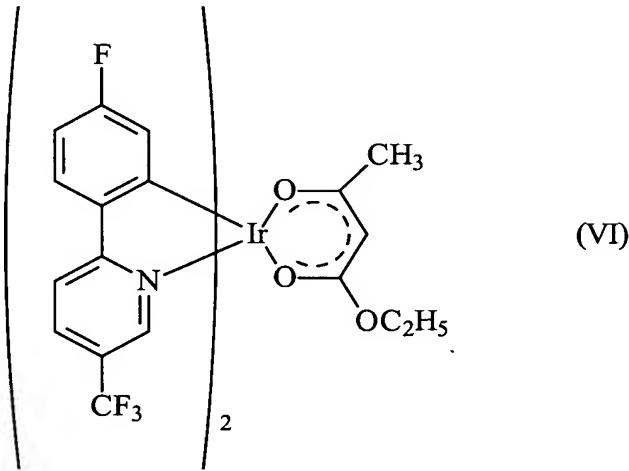


wherein:

25 adjacent pairs of R<sub>1</sub>-R<sub>4</sub> and R<sub>5</sub>-R<sub>8</sub> can be joined to form a five- or six-membered ring,  
at least one of R<sub>1</sub>-R<sub>8</sub> is selected from F, C<sub>n</sub>F<sub>2n+1</sub>, OC<sub>n</sub>F<sub>2n+1</sub>, and OCF<sub>2</sub>X, where n = 1-6 and X = H, Cl, or Br, and  
A = C or N, provided that when A = N, there is no R<sub>1</sub>.

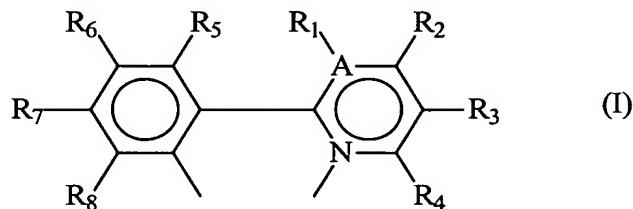
- 30 2. The device of Claim 1 wherein x = 1, y = 0, and z = 0.  
3. The device of Claim 2 wherein A = C and none of R<sub>1</sub>-R<sub>8</sub> is selected from nitro.  
4. The device of Claim 1 wherein R<sub>3</sub> is CF<sub>3</sub>.

5. The device of Claim 4 wherein at least one of R<sub>5</sub>-R<sub>8</sub> is selected from F, C<sub>n</sub>F<sub>2n+1</sub>, OC<sub>n</sub>F<sub>2n+1</sub>, and OCF<sub>2</sub>X, where n = 1-6 and X = H, Cl, or Br.
6. The device of Claim 2 wherein A = C, R<sub>3</sub> = CF<sub>3</sub>, R<sub>7</sub> = F, and R<sub>1</sub>, R<sub>2</sub>, R<sub>4</sub>-R<sub>6</sub> and R<sub>8</sub> = H.
- 5      7. The device of Claim 2 wherein A = C, R<sub>3</sub> and R<sub>6</sub> = CF<sub>3</sub>, and R<sub>1</sub>, R<sub>2</sub>, R<sub>4</sub>, R<sub>5</sub>, R<sub>7</sub> and R<sub>8</sub> = H.
8. The device of Claim 2 wherein A = C, R<sub>3</sub> = CF<sub>3</sub>, R<sub>6</sub> and R<sub>8</sub> = F, and R<sub>1</sub>, R<sub>2</sub>, R<sub>4</sub>, R<sub>5</sub>, and R<sub>7</sub> = H.
9. The device of Claim 1 wherein x = 0 and y = 1 having a structure (VI)
- 10     below:



10. An organic electronic device comprising an emitting layer wherein the emitting layer comprises a diluent and less than 20% by weight of at least one compound that has a formula below:
- 15

20      $\text{IrL}^a\text{L}^b\text{L}^c$ ,  
where:  
L<sup>a</sup>, L<sup>b</sup> and L<sup>c</sup> are alike or different from each other and each of L<sup>a</sup>, L<sup>b</sup> and L<sup>c</sup> has structure (I) below:



wherein:

adjacent pairs of R<sub>1</sub>-R<sub>4</sub> and R<sub>5</sub>-R<sub>8</sub> can be joined to form a five- or six-membered ring,

5 at least one of R<sub>1</sub>-R<sub>8</sub> is selected from F, C<sub>n</sub>F<sub>2n+1</sub>, OC<sub>n</sub>F<sub>2n+1</sub>, and OCF<sub>2</sub>X, where n = 1-6 and X = H, Cl, or Br, and A = C or N, provided that when A = N, there is no R<sub>1</sub>.

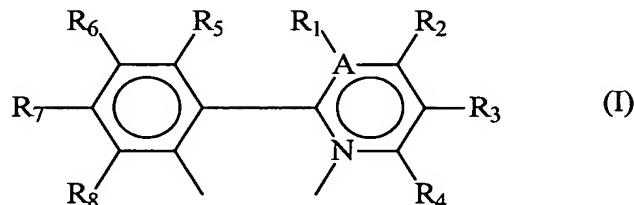
11. The device of Claim 10 wherein the diluent is selected from poly(N-vinyl carbazole), polysilane, 4,4'-N,N'-dicarbazole biphenyl, and tertiary aromatic amines.

10 12. The device of Claim 1, further comprising a hole transport layer selected from N,N'-diphenyl-N,N'-bis(3-methylphenyl)-[1,1'-biphenyl]-4,4'-diamine (TPD), 1,1-bis[(di-4-tolylamino) phenyl]cyclohexane (TAPC), N,N'-bis(4-methylphenyl)-N,N'-bis(4-ethylphenyl)-[1,1'-(3,3'-dimethyl)biphenyl]-4,4'-diamine (ETPD), tetrakis-(3-methylphenyl)-N,N,N',N'-2,5-phenylenediamine (PDA),  $\alpha$ -phenyl-4-N,N-diphenylaminostyrene (TPS), p-(diethylamino)-benzaldehyde diphenylhydrazone (DEH), triphenylamine (TPA), bis[4-(N,N-diethylamino)-2-methylphenyl](4-methylphenyl)methane (MPMP), 1-phenyl-3-[p-(diethylamino)styryl]-5-[p-(diethylamino)phenyl] pyrazoline (PPR or DEASP), 1,2-trans-bis(9H-carbazol-9-yl)cyclobutane (DCZB), N,N,N',N'-tetrakis(4-methylphenyl)-(1,1'-biphenyl)-4,4'-diamine (TTB), porphyrinic compounds, and combinations thereof.

15 13. The device of Claim 1, further comprising an electron transport layer selected from tris(8-hydroxyquinolato)aluminum, 2,9-dimethyl-4,7-diphenyl-1,10-phenanthroline (DDPA), 4,7-diphenyl-1,10-phenanthroline (DPA), 2-(4-biphenyl)-5-(4-t-butylphenyl)-1,3,4-oxadiazole (PBD), 3-(4-biphenyl)-4-phenyl-5-(4-t-butylphenyl)-1,2,4-triazole (TAZ), and combinations thereof.

20 14. A compound having a formula selected from *fac*-Ir(L)<sub>3</sub>, *mer*-Ir(L)<sub>3</sub>, and combinations thereof, where L is selected from group 1-a through 1-m and 1-q through 1-v, as shown in Table 1, and has structure (I) below:

30

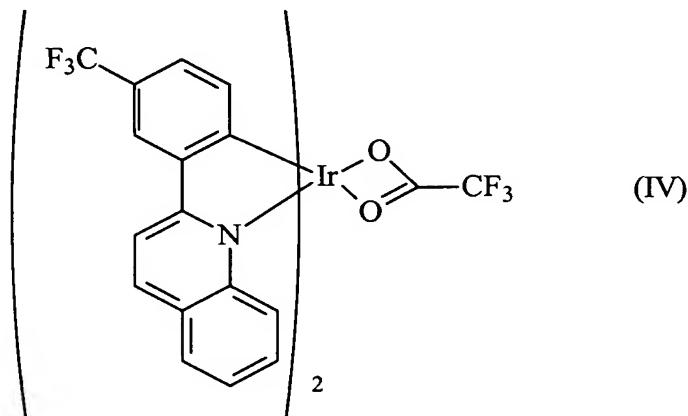


wherein:

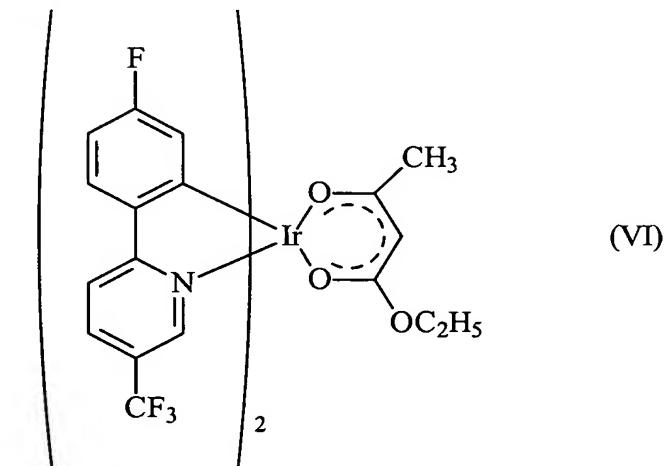
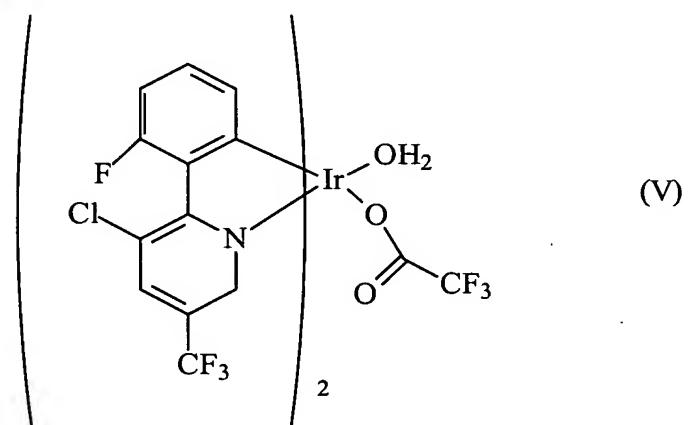
adjacent pairs of R<sub>1</sub>-R<sub>4</sub> and R<sub>5</sub>-R<sub>8</sub> can be joined to form a five- or six-membered ring,

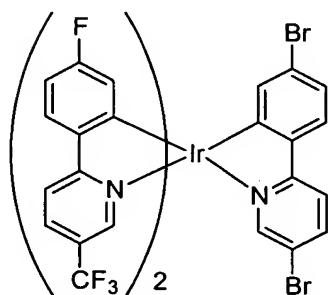
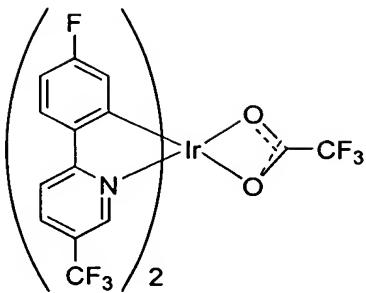
at least one of R<sub>1</sub>-R<sub>8</sub> is selected from F, C<sub>n</sub>F<sub>2n+1</sub>, OC<sub>n</sub>F<sub>2n+1</sub>, and OCF<sub>2</sub>X, where n = 1-6 and X = H, Cl, or Br, and  
5 A = C or N, provided that when A = N, there is no R<sub>1</sub>.

15. A compound having a structure selected from structures (IV), (V), (VI), (IX) and (X) below:



10

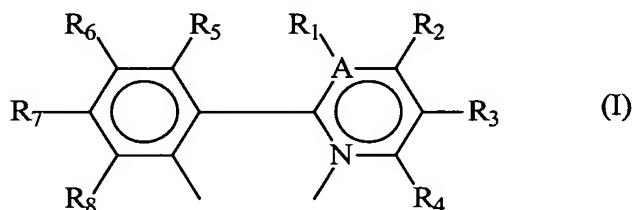




5

16. An organic electronic device comprising an emitting layer that comprises a compound selected from the following (i) and (ii):

10 (i) a compound having a formula selected from *fac*-Ir(L)<sub>3</sub>, *mer*-Ir(L)<sub>3</sub>, and combinations thereof, where L is a group selected from 1-a through 1-m and 1-q through 1-v, as shown in Table 1 and has structure (I) below:



15

wherein:

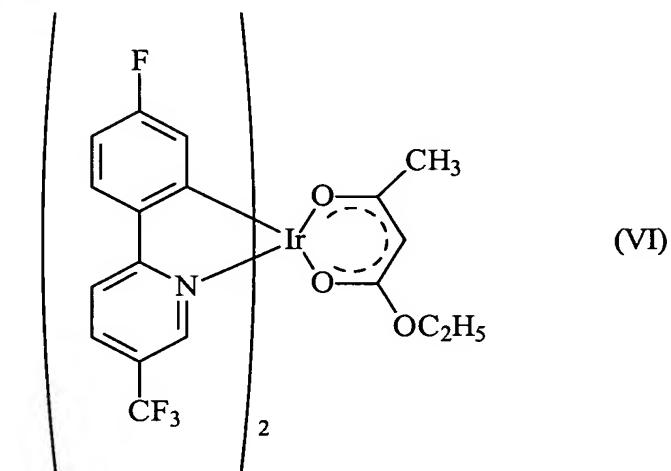
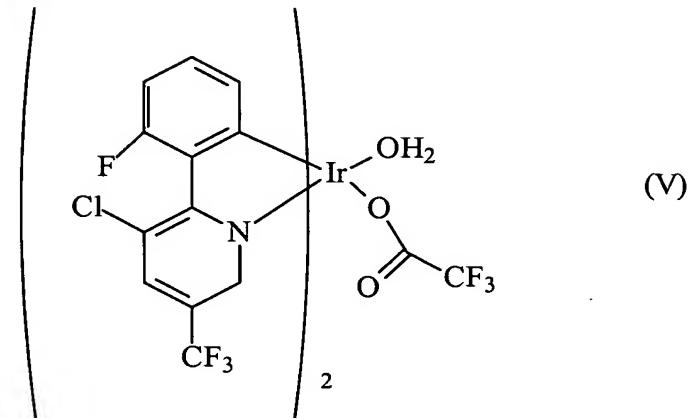
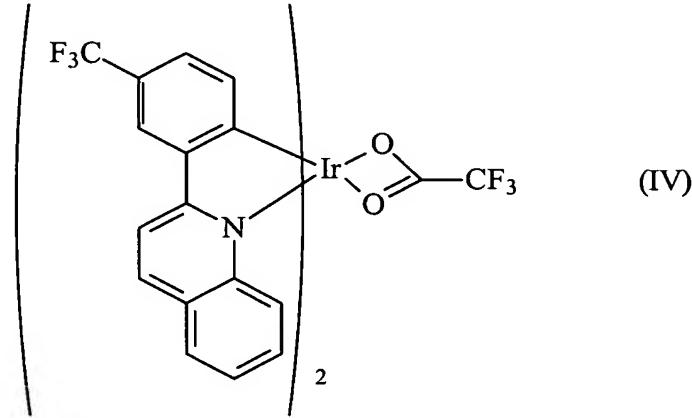
adjacent pairs of R<sub>1</sub>-R<sub>4</sub> and R<sub>5</sub>-R<sub>8</sub> can be joined to form a five- or six-membered ring,

20 at least one of R<sub>1</sub>-R<sub>8</sub> is selected from F, C<sub>n</sub>F<sub>2n+1</sub>, OC<sub>n</sub>F<sub>2n+1</sub>, and OCF<sub>2</sub>X, where n = 1-6 and X = H, Cl, or Br, and

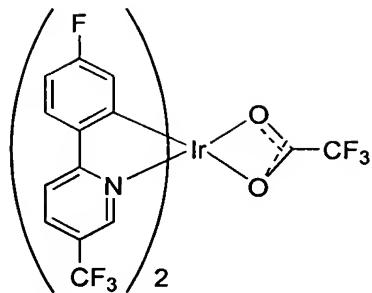
A = C or N, provided that when A = N, there is no R<sub>1</sub>;

(ii) a compound having one of structures (IV), (V), (VI), (IX), and (X)  
below:

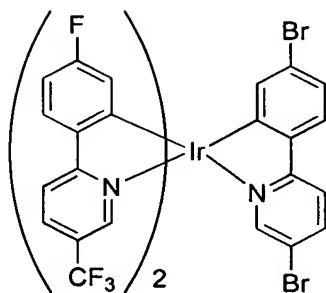
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10



(IX)



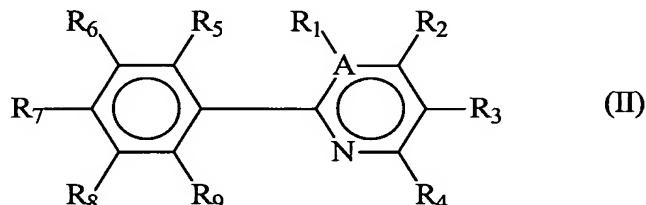
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(X)

17. The device of Claim 16 wherein the emitting layer further comprises a diluent.

18. The device of Claim 17 wherein the diluent is selected from poly(N-vinyl carbazole), polysilane, 4,4'-N,N'-dicarbazole biphenyl, and tertiary aromatic amines.

19. A compound selected from compounds 2-a through 2-aa as shown in Table 2, having structure (II) below:



15

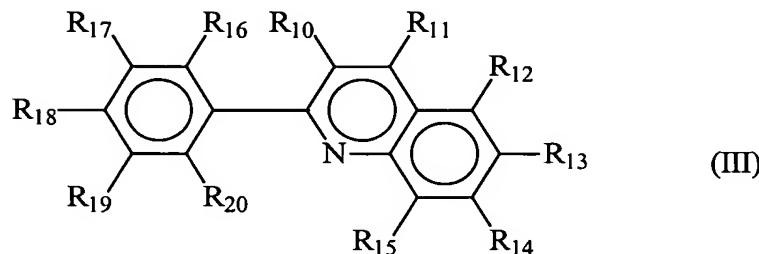
wherein: R<sub>9</sub> is H;

adjacent pairs of R<sub>1</sub>-R<sub>4</sub> and R<sub>5</sub>-R<sub>8</sub> can be joined to form a five- or six-membered ring;

at least one of R<sub>1</sub>-R<sub>8</sub> is selected from F, C<sub>n</sub>F<sub>2n+1</sub>, OC<sub>n</sub>F<sub>2n+1</sub>, and OCF<sub>2</sub>X, where n = 1-6 and X = H, Cl, or Br, and A = C or N, provided that when A = N, there is no R<sub>1</sub>.

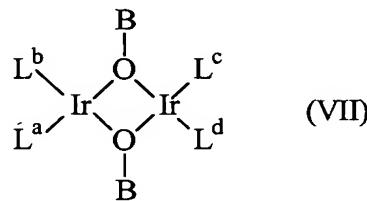
20. A compound having structure (III) below:

5



wherein R<sub>17</sub> = CF<sub>3</sub> and R<sub>10</sub>-R<sub>16</sub> and R<sub>18</sub>-R<sub>20</sub> = H.

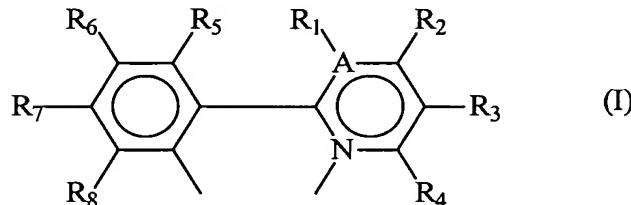
10 21. A compound having structure VII below:



wherein:

B = H, CH<sub>3</sub>, or C<sub>2</sub>H<sub>5</sub>;

15 L<sup>a</sup>, L<sup>b</sup>, L<sup>c</sup>, and L<sup>d</sup> are the same or different from each other; and each of L<sup>a</sup>, L<sup>b</sup>, L<sup>c</sup>, and L<sup>d</sup> has structure (I) below:



20 wherein:

adjacent pairs of R<sub>1</sub>-R<sub>4</sub> and R<sub>5</sub>-R<sub>8</sub> can be joined to form a five- or six-membered ring,

25 at least one of R<sub>1</sub>-R<sub>8</sub> is selected from F, C<sub>n</sub>F<sub>2n+1</sub>, OC<sub>n</sub>F<sub>2n+1</sub>, and OCF<sub>2</sub>X, where n = 1-6 and X = H, Cl, or Br, and A = C or N, provided that when A = N, there is no R<sub>1</sub>.

22. The compound of Claim 21 wherein:

$L^a = L^b = L^c = L^d$ ;

$B = H$ ;

$R_3 = CF_3$ ;

$R_7 = F$ ;

$R_1, R_2, R_4-R_6$  and  $R_8 = H$ .

5